PHMC Lessons Learned **Fluor Hanford Inc.**

Caution Bulletin

Hexavalent Chromium Exposure, Implementing Effective Controls for New or Revised OSHA Requirements

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Summary:

Efforts by two Hanford contractors to implement revised Occupational Safety & Health requirements for Hexavalent Chromium [Cr(VI)] were less than adequate and contributed to potential overexposure of workers. Less than adequate job hazards analyses implementation resulted in new requirements not being fully integrated into work planning processes.

The revised OSHA requirements specifically call for the use of engineered controls (including the use of local exhaust ventilation) and that adequate respiratory protection be worn to maintain exposures below the new permissible exposure limit (PEL) for Cr(VI).

Discussion of Activities:

On February 28, 2006, the Occupational Safety and Health Administration (OSHA) lowered its PEL for Cr(VI) from 52 micrograms per cubic meter of air ($\mu g/m^3$) as an 8-hour time-weighted average to 5 $\mu g/m^3$ because it had been determined that the risk for lung cancer in workers exposed to Cr(VI) increases at levels below the original PEL. The revision to the OSHA standard caused the effectiveness of engineered controls and use of adequate respiratory protection for welding activities to be re-evaluated in light of the revised Cr(VI) PEL.

Three events occurred at the Hanford site between September of 2006 and February 2007 involving worker potential overexposure to Cr(VI) above the revised PEL. Two of the events occurred at Fluor Hanford Inc. (FH) managed facilities and the third at the Hanford Waste Treatment Plant construction site managed by Bechtel National Inc. (BNI). In each of the events engineering controls were not used and workers were not provided with adequate respiratory protection to ensure the OSHA PEL's were not exceeded.

Both Hanford Contractors recognized early on that there would be impacts from implementing the revised OSHA standard. The early recognition provided adequate time to ensure that the revised standard could be implemented by the November 27, 2006 enforcement date.

Fluor Hanford Inc. determined that implementation of the new standard would require air samples be collected to produce the required exposure determination. By November 27, 2006 FH had collected about 70 IH sample results covering most relevant activities. Review of the results indicated that plasma arc cutting, plasma arc gouging, shielded-metal arc welding (SMAW) and flux-core arc welding (FCAW) each presented exposure potentials above the OSHA PEL. Bechtel National Inc. performed similar sampling and arrived at the same conclusions as FH.

FH was able to exclude a number of activities from having an exposure potential for Cr(VI) such as sanding, soldering, brazing, tack welding and the mechanical cutting of chromium-containing metals.

FH communicated the revised OSHA requirements by issuing a Management Directive (MD) in November 2006. The MD included respiratory protection requirements. In addition, awareness training on Cr(VI) was provided to the Industrial Hygiene staff, welders and painters.

Bechtel National Inc. performed an Environmental, Safety and Health program assessment of Waste Treatment Plant activities in April of 2006 and determined that additional training would be required for employees to enter regulated work areas where exposure to Cr(VI) was anticipated.

Analysis:

These events involved the use of shielded metal arc welding (SMAW) products containing high chromium content. Existing FH Job Hazards Analyses (JHA) for welding were reviewed but not revised to specify any unique controls, such as respiratory protection or local exhaust ventilation, as was called for in the Material Safety Data Sheet (MSDS). The JHA did not specify the use of respiratory protection or additional controls, such as ventilation equipment. Standard welding personal protective equipment was utilized with the addition of an IH personal lapel sampler.

During the required review of the subcontractor's Job Safety Analysis (JSA) covering welding activities, FH personnel did not recognize the ventilation and respiratory protection requirements in the MSDS to keep fumes and gases below the Threshold Limit Value and authorized the work under existing controls. In addition, controls established in Management Directive, *Requirements to Control Exposures to Hexavalent Chromium* for welding, cutting and grinding involving chromium-based alloys, rods and wire, published on November 27, 2006 to address the control of exposures to Cr(VI) during work activities, were not applied.

Bechtel National Inc. discovered that, while the welding safety procedure required local exhaust ventilation and respiratory protection, the existing JHA for welding did not specify any unique controls for SMAW on stainless steel. Information on the Cr(VI) standard was also the subject of a December 2006 Safely Speaking. Weaknesses were identified concerning the reliance on this type of format to convey important information or requirements to the workers.

BNI determined that the potential exposure above the PEL was the result of a failure to properly assess hazards and establish controls. The worker used a half-face respirator, but did not have a local exhaust in place. The hierarchy for protection is 1) engineering methods, 2) administrative methods, and 3) by the proper use of person protective equipment. It was discovered that workers did not know the hierarchy.

Although both contractors put forth a great deal of effort to ensure adequate implementation of the new OSHA PEL requirements, potential overexposures occurred.

The following key issues contributed to the inadequate implementation of the new requirement.

- The potential impacts of assigning actions to implement the new requirements were not adequately assessed to ensure that they were implemented in a timely manner. These implementing actions were ongoing when the last two events occurred.
- Both contractors extensively used email and other informal communication methods to convey the new requirements to the field and to provide related training. These methods did not provide an adequate means to communicate the information to a targeted audience and ensure successful retention and implementation.
- Welders were the primary group targeted by FH. Awareness training on Cr(VI) was provided to the Industrial Hygiene staff, welders, and painters. However, the combination of awareness training and the issuance of the Management Directive (MD) proved ineffective in implementing the respiratory protection requirement for all workers potentially involved with Cr(VI).
- Work practices and procedures for planning welding and grinding work and for identifying hazards did not provide sufficient guidance concerning analyzing the hazards associated with skill based work. Also, the Job Hazards analysis process lacked sufficient rigor and clarity regarding identifying existing and potential workplace hazards such as Cr(VI).
- Certain "strong rules" e.g., historical or workgroup-based work practices are observed by workers including: face shields provide protection from welding fumes; respiratory protection is not needed for outside work; carbon steel does not present an exposure hazard; and short duration jobs cannot result in overexposure.

Recommended Actions:

1. Establish and utilize a formal process to promptly assess impact and risk associated with the implementation of new safety and health requirements.

2. Communicate changes to Safety & Health requirements by more formal communication methods. Notices, Bulletins, Alerts and email should not be the primary communication method used to transmit changes to safety requirements

3. Ensure actions and due dates assigned to implement new or changing requirements are based on impact and risk and that potential impacts to changing due dates are thoroughly understood.

4. Improve general worker knowledge about welding fume exposures and challenge 'strong rules' and outdated beliefs regarding welding fumes by using training, briefings and publicly available information such as the "Welding Fume and Control Techniques" video provided at this link. http://www.cdc.gov/elcosh/abstracts/a000001-a000100/a000076.html

Cost Savings/Avoidance: Not determined

Work Function: OS&H - PPE, welding, burning, hot work

Hazards: Personal Exposure - Airborne Materials

Keywords: hexavalent chromium, hot work, respiratory protection, welding

Originator: Fluor Hanford Inc. and Bechtel National Inc.

Contact: PHMC Lessons Learned; *(509) 372-2166; e-mail: PHMC_Lessons_Learned@rl.gov*

References: ES&H Bulletin 2006-01 Hexavalent Chromium